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ABSTRACT

As a followup study, the academic performance of 120 black students who entered North Carolina State University as new freshmen in the fall of 1970, 1971, and 1972 was examined in order to determine whether the University Predicted Grade Average (UPGA) equation is biased for black students. Major findings are: (1) for both marginal black students and for all black students combined, the UPGA equation tends to over-predict first year grade point average (GPA) of black freshmen and thus is biased in favor of these students; (2) a prediction equation that used only SAT-V or SAT-M and that was developed on the basis of all freshmen combined would under-predict GPA for black students near the cut-off point of 1.6 and thus would be biased against these black students; and (3) a prediction equation that used only converted high school rank (CHSR) and that was developed on the basis of all freshmen combined would over-predict GPA for black students and thus would be biased in favor of these students. (SW)

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BIAS IN THE PREDICTION OF ACHIEVEMENT AND IN ADMISSION OF BLACK STUDENTS TO NORTH CAROLINA STATE UNIVERSITY

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Student Affairs Research
Division of Student Affairs

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SUMMARY

As a follow-up to an earlier study, the Department of Student Affairs Research has studied the academic performance of 120 black students who entered NCSU as new freshmen in the fall of 1970, 1971, and 1972. The purpose of the study was to determine whether the UPGA equation is biased (consistently over-or under-predicts actual GPA's) for black students. The earlier study involved black freshmen entering NCSU in 1967-70 and indicated that the UPGA equation was slightly biased against marginal black applicants.

Major findings of the current study are:

1. For both marginal black students and for all black students combined, the UPGA equation tends to over-predict first year GPA of black freshmen. The equation is thus biased in favor of these students.

2. A prediction equation which used only SAT-V or SAT-M and which was developed on the basis of all freshmen combined would under-predict GPA for black students near the cut-off point of 1.6 and thus would be biased against these black students.

3. A prediction equation which used only CHSR and which was developed on the basis of all freshmen combined would over-predict GPA for black students and thus would be biased in favor of these students.

BIAS IN THE PREDICTION OF ACHIEVEMENT AND IN ADMISSION OF BLACK STUDENTS TO NORTH CAROLINA STATE UNIVERSITY

The following report summarizes a study made to determine whether there is any bias in the admission of black students to North Carolina State University. The UPGA (University Predicted Grade Average) is the criterion by which a student is admitted to the university. An equation which produces the UPGA is derived from a multiple regression procedure in which converted high school rank (CHSR), Scholastic Aptitude Test - Verbal and Math (SAT-V and SAT-M) are predictor variables used to predict first-year grade-point average (GPA), the criterion variable. The equation is developed from data for all new freshmen in a given year and is used to admit all freshmen applicants during the subsequent year. A UPGA of 1.6 is generally used as the cut-off point for admission to N.C. State. A similar study of black freshmen who entered N.C. State between 1967 and 1970 - conducted by the Department of Student Affairs Research in December, 1971 - concluded that use of the UPGA equation is slightly biased against marginal black applicants.

For purposes of this study, the UPGA equation will be considered biased for black students if it consistently over- or under-predicts their first-year GPA. Specifically, if the UPGA consistently under-predicts (predicts GPA's which are below actual GPAs for black students), then it is considered biased against black students. Predicted GPA's for black students using the UPGA equation (based on all entering freshmen) will be compared to their actual GPA's and to predictions using an equation developed specifically for black students.

The study is based on all black students (N=120) who entered NCSU as new freshmen in the years 1970-72. Verbal and math scores from the SAT, CHSR, and first-year GPA were collected for each of these students. Mean scores of these variables for black students and for all new freshmen (including black students) who entered NCSU in fall, 1972 are shown in Table 1. For both the verbal and math sections of the SAT, black students scored significantly lower than the total group. Conversely, high school rank is significantly higher for black students. Black students had a mean first-year GPA of 1.86 compared to a mean GPA of 2.14 for the total group. Thus, there are significant differences in mean scores between black students and total freshmen for the three predictor variables and the criterion variable used in the

regression analysis to determine the UPGA equation.

TABLE 1

MEAN SATV, SATM, CHSR, AND 1st YEAR GPA FOR BLACK FRESHMEN AND ALL NEW FRESHMEN, FALL 1972

	Black N=120	Total N=2222
SATV	42.7	49.0*
SATM	48.8	54.8*
CHSR	61.7	59.4*
1st Year GPA	1.86	2.14*

*Difference significant at α = .05

The multiple regression procedure was used with data for the 120 black students to derive an equation which best predicts GPA for black students. The equation derived from this analysis (BPGA equation) and the regular UPGA equation based on all new freshmen who entered fall, 1972 are shown in Table 2. Weightings in the equation and percentages of total weighting are shown for each variable. The multiple correlation coefficient (R), an indication of how well the data fits the equation (R=1 indicates perfect positive correlation), and the standard error of the estimate, the error associated with the equations, are also presented. In the BPGA equation, SAT-V is not used because its addition

TABLE 2

UPGA AND BPGA EQUATIONS

Variable	UPGA Weighting	UPGA Percentage	BPGA Weighting	BPGA Percentage
CHSR	+ .04869402	65.2	+ .02684527	63.3
SATM	+ .01699232	22.8	+ .01554685	36.7
SATV	+ .00896971	12.0		
CONSTANT	-2.12379648		- .55973925	
	R = .4803		R = .3220	
	SE = .8353		SE = .7166	

into the equation does not add substantially to R and, in fact, increases the standard error of the estimate. CHSR carries approximately the same percentage of total weight in both equations (65.2 percent in the UPGA, and 63.3 percent in the BPGA). The SAT-V and SAT-M combined have approximately the same proportion of total weighting in the UPGA equation as the SAT-M alone in the BPGA equation. The equations shown are the best combinations of the three variables - SAT-V, SAT-M, CHSR - for that group of students in terms of a higher R and lower standard error. In other words, no better equation (i.e., with a higher R and a lower standard error) using any combination of SAT-V, SAT-M, and CHSR can be found for these 120 black students than the BPGA equation shown in Table 2. Similarly, the UPGA equation described in this table is the best possible for the total group of fall, 1972 freshmen. Although the R for the BPGA equation (.3220) is not as high as that of the UPGA equation (R = .4803), the BPGA equation more accurately predicts GPA for black students than the UPGA equation.

The important consideration in determining bias, however, is whether the UPGA equation consistently over- or under-predicts GPA for black students. The accuracy of the UPGA equation in predicting first-year GPA for black students is illustrated in Table 3. The difference between mean GPA and mean

TABLE 3

MEAN UPGA AND GPA FOR BLACK STUDENTS, BY UPGA INTERVAL

UPGA Interval	N	Mean UPGA	Mean GPA	Difference	t-value
<1.5	9	1.32	1.35	+ .03	.1358
1.5 - 1.59	6	1.54	1.48	- .06	- .1930
1.6 - 1.69	9	1.66	1.37	- .29	-1.1918
1.7 - 1.79	9	1.74	1.62	- .12	- .4508
1.8 - 1.89	10	1.87	1.93	+ .06	.4845
1.9 - 1.99	11	1.94	1.73	- .21	-1.0781
2.0 - 2.09	19	2.05	2.03	- .02	- .1613
2.1 - 2.19	14	2.17	2.27	+ .10	.6375
2.2 - 2.29	10	2.26	1.86	- .40	-1.2891
2.3 - 2.39	8	2.36	2.04	- .32	-1.2990
2.4 - 2.49	8	2.44	2.15	- .29	-1.0086
2.5 or greater	6	2.67	2.08	- .59	-1.1816
TOTAL	119	1.99	1.85	- .14	-2.1910*

*Significant at α = .05

UPGA and the value of *t* obtained from testing the difference are shown by UPGA interval. A positive difference indicates under-prediction while a negative difference means that students in that UPGA category did not perform as well as predicted, i.e., over-prediction. In three UPGA categories (<1.5, 1.8-1.89, and 2.1-2.19) under-prediction is observed, but the difference is not significant at the .05 level. For the purpose of admission, however, the crucial predictions are those around the cut-off point on the criterion variable. For the intervals above and below the cut-off point of 1.6 (1.5-1.59 and 1.6-1.69) the UPGA tends to over-predict GPA for black students. Once again over-prediction in these intervals is not significant at the .05 level. For the group as a whole, the difference between mean UPGA and mean GPA is positive and is significant at a probability level of .05. Thus for all students combined, the UPGA equation is slightly biased in favor of black students since it tends to over-predict. This finding indicates that the UPGA equation produces higher UPGA's and thus admits more black students than would an equation developed especially for black students.

The analysis to this point has centered around an evaluation of the UPGA equation and its predictability for black students. Since the UPGA equation as a whole is slightly biased, the following analysis will investigate each of the predictor variables separately to determine whether each contributes to this bias. Single-order relationships between each of the three predictor variables and the first-year cumulative GPA are shown pictorially in Figures 1-3. Regression lines shown in these figures represent the equation which uses each variable separately to predict GPA. Two equations are shown, one for black students and one for total students. The broken line represents the value on each predictor variable needed to predict a GPA of 1.6 using the BLACK and the TOTAL equation.

In Figure 1, the relationship between SAT-V and GPA is shown. The almost horizontal BLACK regression line illustrates the small correlation between SAT-V and GPA for black students. The 1.6 GPA line does not intersect the BLACK regression line, and thus any SAT-V score would admit a student using this equation. An SAT-V score of 30 is required to achieve a 1.6 using the TOTAL equation. For SAT-V scores up to 38, the TOTAL SAT-V equation under-predicts GPA for black students and thus would be biased against them in determining admission. For scores of 38 or greater, the TOTAL SAT-V equation over-predicts GPA for black students.

FIGURE 1. RELATIONSHIP BETWEEN SATV AND FIRST-YEAR CUMULATIVE GPA FOR BLACK AND TOTAL STUDENTS.

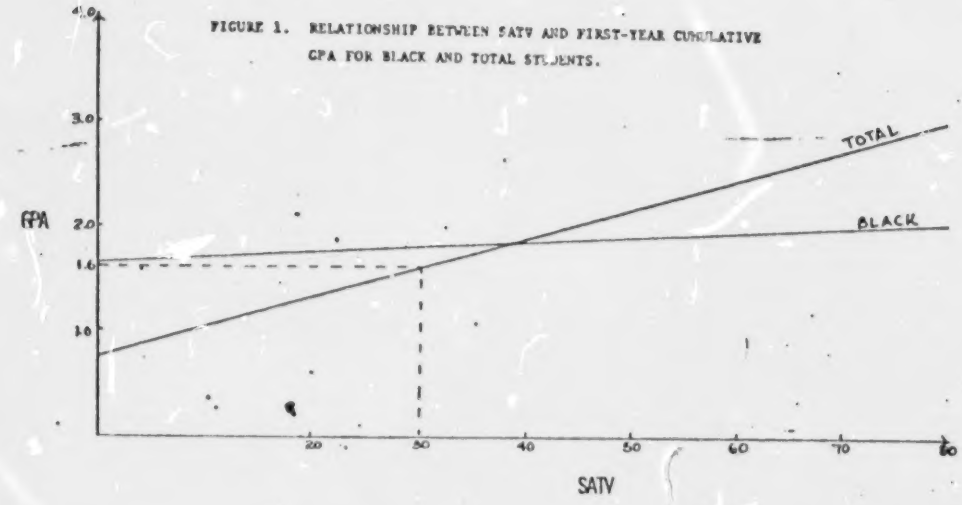


FIGURE 2. RELATIONSHIP BETWEEN SATM AND FIRST-YEAR CUMULATIVE GPA FOR BLACK AND TOTAL STUDENTS.

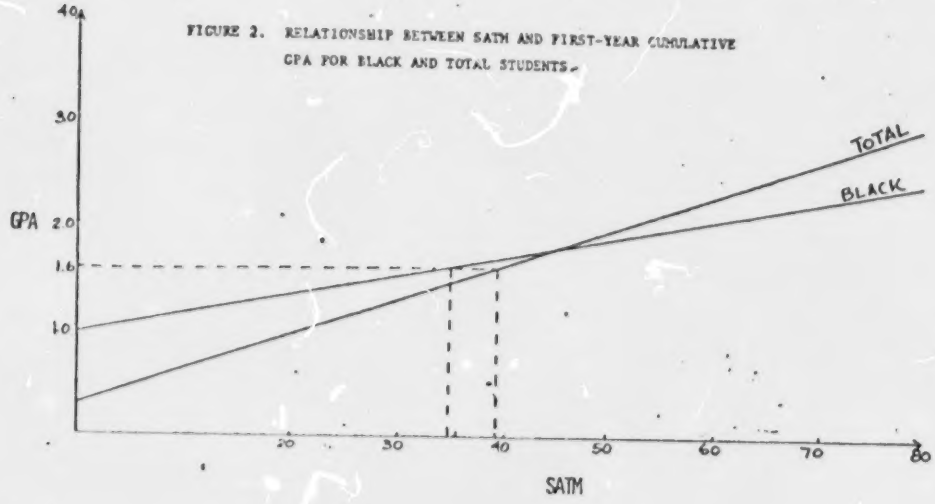
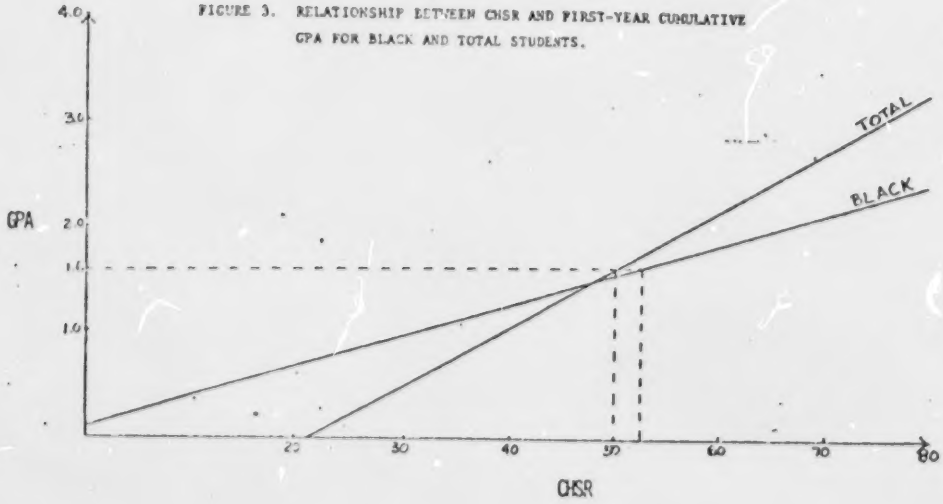


FIGURE 3. RELATIONSHIP BETWEEN CHSR AND FIRST-YEAR CUMULATIVE GPA FOR BLACK AND TOTAL STUDENTS.



Correlation between SAT-M and GPA is shown in Figure 2. Using the BLACK equation, a SAT-M score of 35 is required for a 1.6 GPA, compared to a 39 using the TOTAL equation. Thus, if an equation were adopted which used SAT-M to predict GPA, a student would be admitted with a SAT-M of 35 on the BLACK equation but would need a 39 on the TOTAL equation. The two equation lines crossed at the SAT-M score of 44. Thus for SAT-M scores up to this point, the SAT-M TOTAL equation under-predicts GPA for black students and would be biased against them for admission, but for scores above this point, the TOTAL SAT-M equation over-predicts GPA for black students and is biased in their favor.

For the relationship between CHSR and GPA, Figure 3 illustrates a different phenomenon. In this case, the two lines intersect at a point below the 1.6 GPA, and thus a higher CHSR is required on the BLACK equation (CHSR = 53) than on the TOTAL equation (CHSR = 50) to predict a GPA of 1.6. In contrast to the SAT equations, the CHSR TOTAL equation over-predicts GPA for black students and is thus biased in their favor. Table 4 summarizes the minimum scores necessary to achieve a GPA of 1.6 on the BLACK and TOTAL equations for each of the three variables.

TABLE 4

MINIMUM SAT SCORES AND CHSR REQUIRED FOR ADMITTANCE TO NCSU USING BLACK AND TOTAL UPGA'S

	Black	Total
SATV	No minimum	30
SATM	35	39
CHSR	53	50

In conclusion, when the three variables are used together in the UPGA equation, the opposite biases tend to offset each other, resulting in a prediction which is only slightly biased in favor of black students. For this reason no major change in the prediction of GPA and admission of black students to NCSU seems warrented.

Analysis of another question is needed in the consideration of bias in the admission of black students. This question involves the criterion variable, first year GPA, and whether it is a valid measure of success for black students. Other research by this office indicates that for all freshmen, first year GPA is highly correlated with eventual graduation. This same analysis for black students is currently under investigation by this office and will be summarized in a later report.